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A somewhat less intensely humid forest was here met with, and the fern flora was slightly different from that of the two preceding days.

The great quantities of ferns collected in the Cordillera region of Boquete have not yet been determined, so detailed mention of the species must be deferred. On some future trip to Panama I hope to have an opportunity of exploring the Darien region, that vast, little-known country lying near the Columbian boundary, containing Indian tribes, through whose territory passage has been persistently denied to the white man.

In conclusion I certainly must express my very great gratitude to Mr. William R. Maxon for determining the ferns collected, as well as to Mr. A. S. Hitchcock and Mr. Paul Standley for going over other botanical specimens gathered. I very greatly appreciate, also, the kindness shown me by the Panama Canal officials, and by Mr. H. J. Watson and Col. and Mrs. E. H. Cuthbert, of Boquete.

ON BOARD S. S. "PANAMA,"

EN ROUTE TO NEW YORK, MAY 28, 1918.

Texas Pteridophyta—I.

ERNEST J. PALMER

While making general collections of plants in the Southwest for the Missouri Botanical Garden and Arnold Arboretum during the past few years, I have had an opportunity to observe many of the ferns of Texas in their native environments and to note their distribution over wide areas. Although the present list, perhaps, adds nothing new, unless it be *Lycopodium*, to the reported fern flora of the state, it may be worth while to place on record a number of new localities for some of the species.

The entire area of Texas, excepting that portion lying west of the Pecos River, was more or less thoroughly explored. As many species of ferns are found only in that region they are necessarily excluded from the list. In the portion of the state east of the Pecos thirty-seven species of ferns and ten species and one variety of fern allies were found.

There are two quite distinct fern floras in this region. The eastern part of the state receives an abundant rainfall; over most of the area east of the ninety-seventh meridian the annual precipitation ranges from forty to sixty inches. This is a region of low elevations, with few outstanding relief features, and for the most part it is heavily forested. The geological formations are comparatively recent, ranging from the Upper Cretaceous through the Tertiary and Quaternary. They consist largely of unconsolidated clastics, clays, sands, gumbo and alluvium covering most of the surface, but occasionally there are local outcrops of sandstone, ironstone or marly limestone. Swamps, bogs, bayous and sluggish streams prevail. In such a region moisture and shade-loving ferns naturally predominate.

To the westward the rainfall diminishes gradually, the annual total amounting to only fifteen or twenty inches at the one-hundredth meridian. The northwestern part of the state is occupied by the Plains, and is almost destitute of ferns except for a few species in the deep canyons. To the east is the somewhat broken, rocky and sparsely forested area of Paleozoic rocks, and the black prairies, underlaid by Upper Cretaceous deposits. Very few ferns are found in the prairie region. To the south is the Coastal Plain, extending far up the Rio Grande. To the north of this, and occupying a large area in the southwestern part of the state, is the rocky, semi-mountainous country of the Edwards Plateau, with bold relief features carved

from the limestones of the Comanchean series of Lower Cretaceous age. Over a limited area in Burnet, Llano and Mason Counties igneous rocks, principally granite and rhyolite, occur.

The ferns of this region are largely xerophytic, but a few species common to the eastward have been able to adapt themselves to changed conditions and to maintain themselves along the perennial streams in the deep canyons of the Edwards Plateau, where there is abundant evidence that the forest flora of the Coastal Plain formerly extended.

The serial numbers of collections refer to specimens deposited in the herbarium of the Missouri Botanical Garden, while several sets of duplicates were made of most of them. During two collecting seasons lists were made of ferns noted in addition to specimens collected.

MARSILEACEAE

MARSILEA VESTITA Hook. & Grev. Southerland Springs, Wilson County, 10803; Campbellton, Atascosa County, 11245; Cotulla, Lasalle County, 11299; Uvalde, Uvalde County, 13350; Herrington, Brazos County, 13444; Byrd, Dimmit County, 13548; Quarry, Washington County; Sabinal, Uvalde County; Brownwood, Brown County; Alice, Jim Wells County.

This species appears to be quite common in Southwestern Texas. It is usually found in river bottoms, growing in stiff, black, waxy soil, in ditches and slight depressions, inundated during part of the year and becoming very dry later in the season. As the water recedes or dries up the *Marsilea* fronds spring up, the plants fruit and then die down and remain dormant until again irrigated. At Byrd, Dimmit County, it was found in rather well drained sandy soil. Some of the plants are quite robust and densely clothed with

white hairs on both surfaces, strongly suggesting *Marsilea macropoda*, but wherever it has been found in fruit the sporocarps were solitary.

MARSILEA UNCINATA A. Br. Uvalde, Uvalde County, 11038; San Saba, San Saba County, 11804; Manchaca, Hays County, 12148; Stone City, Brazos County, 13465; Byrd, Dimmit County, 13548; Blanco, Blanco County; Austin, Travis County.

Marsilea uncinata is usually found along spring branches, margins of permanent pools, or where there is a perennial water supply.

SALVINIACEAE

AZOLLA CAROLINIANA Willd. Liberty, Liberty County, 8560; Pledger, Matagorda County.

Grows in still water of swamps and bayous. Probably common near the coast and in Southeastern Texas.

EQUISETACEAE

EQUISETUM HYEMALE L. Columbia, Brazoria County, 5011; Dayton, Liberty County, 9606; Lindendale, Kendall County, 9902; Blanco, Blanco County, 11571; Canyon, Randall County, 12522; Barksdale, Edwards County, 13527; Gamble's Ranch, Armstrong County, 13931; Stephenville, Erath County, 14186; Houston, Harris County.

Found along moist, usually sandy, banks of streams.

EQUISETUM HYEMALE var. *ROBUSTUM* (A. Br.) A. A. Eaton. Menard, Menard County, 11851; Houston, Harris County, 11940.

In similar situations to the species.

EQUISETUM LAEVIGATUM A. Br. Junction, Kimble County, 10927.

Specimens referred to this species, but may possibly be only a form of the last. Growing on moist, calcareous banks of upper San Saba River.

LYCOPODIACEAE

LYCOPODIUM ADPRESSUM (Chapm.) Lloyd & Undw. Grapeland, Houston County, 13187; Keechi, Leon County, 13400; Oakwood, Leon County, 13416.

Growing in sandy bogs with *Triantha racemosa*, *Pogonia divaricata*, *P. ophioglossoides*, *Sarracenia flava*, *Rhexia flava*, *Oxypolis filiformis*, and several other southeastern plants, rarely found in Texas.

SELAGINELLACEAE

SELAGINELLA APUS (L.) Spring. Lacey's Ranch, Kerr County, 9286; Utopia, Uvalde County, 11524; Blanco, Blanco County, 11569; Boerne, Kendall County, 12244; Grapeland, Houston County, 13197.

At Grapeland, Houston County, this species was found growing in sandy bogs. Throughout the Edwards Plateau it is found on springy calcareous banks of streams.

SELAGINELLA ARENICOLA Underw. Fletcher, Hardin County, 9540; Keechi, Leon County, 13411.

Growing in deep, almost pure, sands.

SELAGINELLA RUPESTRIS (L.) Spring. Leakey, Real County, 10146; Devils River, Valverde County, 11389; Del Rio, Valverde County; Utopia, Uvalde County; Blanco, Blanco County; San Saba, San Saba County; Boerne, Kendall County; Montell, Uvalde County; Rock Springs, Edwards County.

On exposed limestone rocks and ledges.

SELAGINELLA LEPIDOPHYLLA Spring. Del Rio, Valverde County, 12364; Devils River, Valverde County, 11366; Montell, Uvalde County.

A Mexican species found on dry limestone ledges of high hills.

OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Marshall, Harrison County, 13215.

This species appears to be quite rare in Texas and is probably limited to the moist, heavily forested eastern section. The specimens collected were growing in rich, alluvial soil of low woods along a small creek. This was compared with a large series preserved in the herbarium of the Missouri Botanical Garden, and, curiously, it, with an identical form collected by the writer at Natchitoches, Louisiana, 7482, and one collected by John H. Kellogg at Fulton, Arkansas, approximate in form and general appearance specimens from central and northern Europe much more closely than they do most of the American material referred to this species.

OPHIOGLOSSUM ENGELMANNII Prantl. San Augustine, San Augustine County, 7102; Brownwood, Brown County, 11432; Houston, Harris County, 11447; Austin, Travis County, 13667.

This species, although it has often been confused with the last in collections, is readily distinguishable by its fleshy, dull green sterile fronds, with apiculate apex, and its usually shorter, stockier habit of growth. It is generally found in large colonies, in thin soil, on limestone ledges or barrens. The specimens from Palestine were growing on knolls in low woods, and those from College Station and Houston in stiff, black soil, in woods near streams. The species is apparently common and widely distributed in Texas.

WEBB CITY, Mo.

(To be continued)